

UNIT NINE

ENVIRONMENTAL MONITORING



Information concerning the characteristics of potential and actual releases of radionuclides are needed to determine emergency action levels (e.g., PAGs), to recommend protective action, and to identify critical exposure pathways. This information can be obtained by environmental monitoring.

This unit will cover the main objectives and purposes for environmental monitoring, as well as the instruments used. This topic is covered in detail in FEMA’s *Radiological Accident Assessment* courses. In this course the unit is intended as a review for those participants who have already mastered the competencies involved, and a critical learning objective for those who have not.

GATE FRAME QUESTION

Define “environmental monitoring” and state at least two purposes for environmental monitoring.





ANSWERS

Your answer should include the adjacent information

Environmental monitoring is the assessment of the actual or potential exposure of an individual to radioactive materials which may be present in his or her environment.

Environmental monitoring is the assessment tool which may also confirm the absence of radioactive materials in the environment.

Purposes for environmental monitoring include:

- Verifying that the release has occurred;
- Providing data for input into analytical models;
- Defining affected areas; and
- Estimating hazards to the public.

If your answer included all or most of the above points, you should be ready for the summary questions at the end of this unit. Turn to page 9-14.

If your answer did not include these points, it would be advisable for you to complete the programmed instruction for this unit. Turn to page the next page.



ENVIRONMENTAL MONITORING



Environmental monitoring is the assessment of the actual or potential exposure of an individual to radioactive materials present in his or her environment. Depending on the nature of the radioactive release, both short-term and long-term environmental monitoring may be necessary.

Short-term measurements, which are performed by emergency personnel during the period of the initial emergency response, are primarily aimed at providing information for analysis and data for determining appropriate action levels and mitigation measures.

Long-term monitoring is generally conducted by supporting or consulting personnel after the release is terminated, and is performed to provide detailed analyses of radiological hazards and accident consequences.

Monitoring results can be used to verify that a release has occurred, provide data for input into analytical models, and define affected areas. Measured data can also be used to estimate hazards to the public.

Conversely, monitoring results may confirm the absence of a radiological hazard.

To test your knowledge of environmental monitoring, answer the following question.

What type of environmental measurements are made to determine appropriate action levels and mitigating measures?

QUESTION

Circle the correct answer

- a. short-term.
- b. long-term.

Turn the page to check your answer.



ANSWERS

- a. Correct answer. Protective actions should be implemented, if warranted, as soon as possible. Short-term measurements would yield results that could provide a basis for decisions leading to a prompt and appropriate emergency response.

Proceed to page 9-6.

- b. Incorrect. Long-term measurements are performed to provide detailed analyses of radiological hazards and accident consequences.

Try another problem.

QUESTION

Environmental monitoring results can be used to estimate hazards to the public.

Circle the correct answer

- a. true.
- b. false.

Turn the page to check your answer.



ANSWERS

- a. You're right.

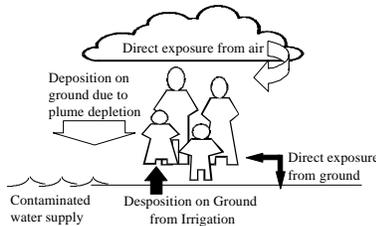
Move on to the next section.

- b. Wrong answer. The statement is true. Radiation data generated by environmental monitoring can help determine whether exposure levels are high enough to create a hazard to the public.

Review this section before moving on to the next section.



ENVIRONMENTAL MONITORING PROGRAMS



EPA's *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents* (EPA 400-R-92-001) identifies three categories of exposure pathways and the dose levels at which protective actions are indicated. Exposure may result from whole body external exposure, inhalation of suspended particulate radioactive materials, or from ingestion of contaminated food and water. An environmental monitoring program must be in place so that in a nuclear incident, potential dose levels in any or all of these potential exposure pathways may be projected.

The function of an environmental monitoring program is to acquire sufficient radiation data to confirm protective action decisions that have been made in time to ensure that radiation exposure to the public will be as low as is reasonably achievable (ALARA). By the same token, it is necessary to consider keeping the cost of the program within reasonable limits, without compromising ALARA exposure, by utilizing existing instrumentation and resources whenever possible. Therefore, planning for the design and implementation of the program must be thorough to assure a rapid and proper response in the event of a radiological accident.

Effective evaluation of gathered information and coordination of environmental monitoring activities require the establishment of a sound environmental monitoring program. This program should be run by a facility staffed by personnel capable of directing field operations and interpreting analytical and measured results. This facility must have reliable communications capability to primary and backup monitoring personnel, emergency directors, laboratory facilities, transportation agencies, and weather services.



Environmental monitoring facilities must be licensed. The license will spell out the extent of the required environmental measurements. Many licenses require that monitoring play a limited role because the radionuclide involved poses little risk to the public. In contrast, facilities such as waste burial grounds, nuclear power stations, and fuel processing plants require extensive monitoring programs.

To check your understanding of these concepts, answer the following question

QUESTION

Circle the correct answer

One reason for maintaining an environmental monitoring program is

- a. to acquire sufficient radiation measurement results to confirm protective action decisions.
- b. to promote the benefits of radionuclides in modern technology.

Turn the page to check your answer.



ANSWERS

- a. Right! The protective action decisions ensure that radiation exposure to the public are at ALARA levels. Such decisions could not be made without knowing the radiation levels at hand.

Continue to the next section.

- b. No. Although radionuclides do play an important role in many facets of today's technology (such as radiotherapeutics and research), their benefits are not promoted by environmental monitoring programs. These programs are designed to provide environmental radiation data that aid in the planning, response, and analysis stages of a radiological incident.

Try another question.

QUESTION

Circle the correct answer

All facilities utilizing radiation should maintain extensive environmental monitoring programs.

- a. true.
- b. false.

Turn the page to check your answer.



ANSWERS

- a. Incorrect. Some facilities use radionuclides in amounts that pose very little risk to the public. These places do not require extensive monitoring. Other facilities may use radionuclides in amounts that are hazardous to the public, and therefore require much more extensive environmental monitoring programs.

You should reread this section before proceeding.

- b. Correct answer. You understand that not all facilities have the same requirements for their environmental monitoring program.

Go ahead with the next section.



ENVIRONMENTAL MONITORING INSTRUMENTATION

AIRBORNE RELEASE



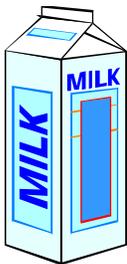
For airborne releases, measurements to be made by initial environmental monitoring teams include dose rate in air, airborne particulate activity, and airborne iodine activity.

Dose rate can be measured using a standard radiation survey detector (movable window ionization detector) held at waist height. This measurement provides an indication of the radiological hazard resulting from whole-body exposure to external gamma rays from immersion in the plume and from ground contamination.

Airborne particulate activity can be measured using high-volume, high-efficiency filtered or impact air samplers. Particulate samples can be evaluated in the field for alpha and beta-gamma activity using standard survey meters.

Fixed instruments used for airborne environmental monitoring include passive dosimeters (thermoluminescent or film), airborne particulate filters, and iodine absorber canisters.

MILK



Iodine-131 is the nuclide of major concern in contaminated milk because it is deposited in the human thyroid and the thyroid is a critical organ. The instrument system currently recommended for field monitoring of milk at the preventive PAG level is a hand-held Sodium Iodide (NaI) detector. This instrument system should be used with the ion exchange method, a filtering and collecting process. However, this system is also sensitive enough to be used with the immersion method for milk sample monitoring. Available information indicates that other types of hand-held instrumentation such as Geiger-Mueller or ion chamber detectors are not sensitive enough for this task.



**NON-DAIRY FOOD
AND WATER****QUESTION**

Circle the correct answer

After emergency monitoring of surface-deposited radioactivity defines the boundaries of contaminated areas, non-dairy food and drinking water within the boundaries should be sampled and analyzed. Laboratory tests on food samples may include strontium analyses or other chemical separations. Field monitoring instrumentation for water should be similar to that recommended for emergency milk monitoring, i.e. immersion counting or ion-exchange resin counting.

Try the following question to apply your knowledge of environmental monitoring instrumentation.

Airborne particulate samples can be collected using

- a. column anion resin exchange.
- b. high-volume, high-efficiency filtered air samplers.

Turn the page to check your answer.



ANSWERS

- a. Wrong answer. Airborne particulate matter is collected using high volume air samplers or fixed particulate filters. The column anion resin exchange method is used for liquids.

Try another problem.

- b. Yes, you are right.

Go ahead to the next section.

QUESTION

Ionization detector measurements provide an indication of the radiological hazard resulting from whole-body exposure to external _____ from immersion in the plume and from ground contamination.

- a. alpha radiation.
- b. gamma radiation.

Turn the page to check your answer.



ANSWERS

- a. No. Ionization detectors can only detect gamma radiation.

You should go back and reread that section before proceeding to the Summary Questions.

- b. Correct answer.

Proceed to the Summary Questions.



SUMMARY QUESTIONS

QUESTION

1. Facilities such as radioactive waste burial grounds, nuclear power stations, and nuclear fuel processing plants
 - a. do not require extensive environmental monitoring programs.
 - b. require extensive environmental monitoring programs.

Turn the page to check your answer.



ANSWERS

- a. Incorrect. The sources at these facilities may produce high level radiation doses. Their licenses require extensive monitoring programs.

Go back to page 9-3 and review before answering the next Summary Question.

- b. Correct.

Move on to the next Summary Question.

QUESTION

2. *Initial* environmental monitoring involves radiation measurements in
- a. air.
- b. food.

Turn the page to check your answer.



ANSWERS

- a. Correct.

Proceed to Unit Ten.

- b. Incorrect. It is unlikely that initial environmental measurements will detect radioactivity in food. Although food contamination does occur, it cannot be measured immediately after the radiological incident.

Go back to page 9-3 and review before proceeding to the next unit.

